Geoinformatics & Geostatistics: An Overview

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Health Geography, Sustainability and its Relevance in Public Health

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Abstract

Health and Geography are interconnected branches of Science. Medical Geography is defined as the study of spatial distribution of health, ill health and diseases as determined by the natural and cultural milieu of human-beings. Analysis of the links between the migration of people and spread of diseases, and environment and health is by its very nature a spatial problem. Levels of risk and vulnerable vary spatially in response to variation in environmental conditions, and as a consequence, the health outcome and associated levels of need and health support vary. This narrative review will outline the relevance of health geography in framing effective public health policy, and scope for the future.

Keywords

Geography, Health, Public health policy

Introduction

Health and Geography are interlinked disciplines of Science. One's health is often governed by where one is born, where they live, the climatic conditions of that place, staple diet and so on [1]. This is most obviously reflected in varying Healthy Life Expectancy seen across different countries [2]. Investigations into migration of population groups from one place to another have also thrown some light on the importance of geographic location on health [3].

Apart from the basics needed for survival such as food, air and water, geography of a place intrinsically governs the disease patterns of a place as well and thereby also the kind of health services that are available to one. The sociodemographic aspects that govern health delivery systems and health policy thereof, are also affected by the geography of a particular region [4]. John Snow's spot map to trace the origin of infected Water Supply in Soho, London during the Cholera epidemic maybe the oldest example in use of health geography (cartogram) in informing Public Health Policy for prevention of disease [5].

Medical Geography is defined as the study of spatial distribution of health, ill health and diseases as determined by the natural and cultural milieu of human-beings [6]. It is impossible to ignore the intrinsic interrelationships between distribution and influence of geographic factors, such as landforms, soil, climate, vegetation, flora and fauna, micro-organism, etc and life of human being. The occurrence of these in single or in collusion with others and the reasons of human's physiology and mind to them, forms the core of medical geographic research [7].

The transitioning from the medical to health geography indicates theparticipation of geography in these wider epistemic shifts and its disciplinary response. In this respect, it shares similarity with other social sciences. Sociology and psychology have experienced analogous changes, as have those aspects of medicine that align most clearly with the social sciences – witness the emergence of nonclinical public health and critical 'upstream' work in health promotion. In all cases, the 'cultural turn' of the 1990s further fueled the transition as the evident flexibility and changeable nature of health was progressively deconstructed [8].

Health Geography is a sub-discipline in the field of Geography which deals with the impact of spatial features on health and the interaction of people with their environment, resulting in health related outcomes. It encompasses the role of a particular place's geography in the wellbeing of those who reside there [9]. New and emerging infectious diseases are one of the best examples to give in emphasising the role of a place and its geographic location in determining health and disease related outcomes [10]. This narrative review will outline the relevance of health geography in framing effective public health policy, and scope for the future.

Health geography: Implications in public health

It is well established that sound epidemiological data forms the basis of framing public health policy. Health Geography is also closely related to epidemiology. While the tenets of the latter are founded on the biomedical concept, the former focuses more on the spatial relations such as the population's susceptibility to a disease based on the area and its challenges. Research in the field of health geography traverses the entire spectrum of healthcare of a particular region. It's concerned with the origin and propagation of disease on one hand and planning for health services, their availability and accessibility on the other hand [4].

The importance of place in health and disease is historically established. A treatise by Hippocrates titled Air, Water and Places bears testimony to this fact [11]. When exploring the research themes of Health Geography, one can understand how closely they are related to Public Health. Research specific to Health Geography and the themes emerging from it have evolved over time. The intricate relationship of this discipline with Pubic Health becomes quite apparent when the research themes within health geography are explored. Jones and Moon highlighted four main types of research procedures in health involving '*places*'. The simplest is comparison of health or health related outcomes across townships. The second category includes assessment of internal variations in one particular location or place. The third type is a migration study that is comparison of indigenous populations to those who have migrated there and learn the effect of place on health. The last type includes national surveys to determine variations within a nation and factors leading to the variations [12].

It is apparent from the outline of these research themes that matters of public health interest are often dependent on these spatial factors. A simple exercise of health needs assessment of a population will be dependent on the location. Table 1 attempts to illustrate certain

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Table 1: Examples of Research themes of Health Geography in Public Health Related Research.

Research Area	Example
Spatial Factors, Land use planning	Planning for health infrastructure and land allocation for the same [13]
Disease Surveillance	Use of Geographic Information Systems in mapping infectious disease [14]
Etiology of disease (environmental risk factors)	Prevalence of Endemic Goiter [15] Prevalence of Fluorosis [16]
Use of Health Services	Utilization of health care services and government schemes [17]
Inequalities in health-related outcomes	Urban – Rural divide in health status [18]

examples in Public Health related research and the corresponding Health Geography themes that are dominant in them [13-18].

As implied earlier, health geography is concerned with effect of both '*space*' and '*place*' on health and health related parameters.

'Space' implies the availability of physical space, distances and spatial configuration of societies, more often than not influenced by other social factors such as residential distribution in a region. '*Place*' usually refers to the locale or the location. Both these factors are crucial to public health [13]. For instance, an outbreak will spread more rapidly in a densely populated area or the geography of a 'location' may affect the kind of health services available there. The simplest of exercises in Public Health Planning such as needs assessment is heavily dependent on the '*place*' and also the factors governing '*space*'.

It is thus quite apparent as to how Health Geography affects and more importantly informs Public Health Policy decisions. In the most recent example of the COVID 19 Pandemic this has become more evident. Mapping of new infections, pace of vaccination and even emergence of new variants all are dependent on geography of the region. Health geography has in effect governed important Public Health policy decisions such as closing international borders amidst this Pandemic.

Of course, the variety and nature of factors with a potential effect on '*geographical*' differences in health depend on the characteristics of the localities under scrutiny, particularly their size. A comparison between neighbourhoods of a city is not like a comparison between neighbourhoods of different cities, and even less like comparisons between cities, departments or regions. Factors relating to the histories of places, and especially of their inhabitants, vary according to the place concerned. Living conditions and lifestyles also differ greatly from place to place, even when communities have much in common in terms of social health inequality (differences between categories or social classes are proportionate but their importance varies according to the size and the nature of the places compared). Some authors [19,20] have proposed adding a third notion to composition and context – a collective dimension reflecting the cultural and historical traits of communities. This 'explanation' would emphasise shared norms, traditions, values and interests, thus adding an anthropological dimension to the socio-economic, psychological and epidemiological considerations addressed in geographical approaches. While approving of that approach, there is need to maintain a separation between context and the collective dimension, which does nothing but enlarges the context by including historical and socio-anthropological aspects [21].

A country as vast and diverse as India, exhibiting multiple geographic and topographic features within one country requires a keen understanding of Health Geography in order to effectively plan Public Health Policy. The following section will outline these concepts specifically in terms of India.

Impact of health geography in framing public health policy in India

The impact of health geography in framing Public Health Policy in Indiacan be due to following factors:Accessibility of Health Care services being a major issue, Rural – Urban Divide, Topographic Challenges in providing adequate health care and patterns of the Infectious diseases and locality – Difference in the pattern of spread in different locations.

The health status of an individual, a community or a nation is determined by the interplay and integration of two ecological universes – the internal environment of human beings themselves and the external environment, which surround them [22]. Environmental problems and their corresponding impacts on health vary between urban and rural areas. In rural areas unsafe drinking water and inadequate excreta disposal combined with contaminated food are responsible for a majority of illnesses. On the other hand, environmental problems in urban areas are the results of rapid and massive urban bound population migration and of uncontrolled industrialization and urbanization. Municipal services are unable to keep pace with the urban growth like providing adequate water supply, sewerage and sanitation [23].

The public health system has a gross shortfall of the medical and paramedical staff. As per the estimate of the Government on the basis of the vacancies of the sanctioned posts, 18% primary health centres are still without a doctor, with about 38% lacking a laboratory technician, and 16% do not have a pharmacist [24]. There is shortage of the specialist allopathic doctors in thepublic sector with 52% sanctioned posts for the specialists at community health centres being vacant. Of these vacant posts, 55% are for surgeons, 48% are for obstetricians and gynaecologists, 55% are for physicians and around 47% are for the paediatricspecialist. There is vacancy at the nursing level with 18% posts vacant at staff nurse and auxiliary nurse midwives level at the primary and community health centres [24].

The reported number of staff becomes more inadequate if some of the staff is off-duty in these primary and community health centres. In the public sector, shortages of laboratory technicians, and pharmacists also exist. Similarly, the private sector has a lack of qualified health-care providers. Many unqualified healthcare providers are working in the private sector, particularly in rural areas and in urban slums [25,26].

The deficiency of the health workers in rural areas is due to the combination of disinclination of qualified private providers for working there and public sector's inability in attracting and inadequacy of thestaff in the rural health facilities. Many health workers prefer to work in urban rather than rural locations because, in urban areas, they can earn a better income, can work more effectively (because of better access to, for example, equipment and facilities), have good living conditions, and have safe working and living environments, and because their children can have better education opportunities [27,28].

Challenges pertaining to 'space' in control of infection – Case in point COVID -19 – many homes not equipped for isolation – congested – leading to policy decisions such as isolation centres which are again dependent on land allocation for the same – goes back to policy related decisions which need to be made well in advance (vision) Environmental Challenges.

Future Scope

The future of health geography depends upon the Integration of GIS with National Health systems database, Real time notification of disease based on location and identification of the road blocks in rural urban health equity.

Conclusion

Studying the medical geography or geography of health is essential forthe key to understanding and prevailing of the patterns of diseases over geographical areaand time. The factors and processes of the growth and variation of diseases related to environment and dietary status of the people within a spatial unit can best be understood by geographers because the key to the nature, occurrence, prevention and control of diseases lies in the environment. Analysis of the links between the migration of people and spread of diseases, and environment and health is by its very nature a spatial problem. Levels of risk and vulnerable vary spatially in response to variation in environmental conditions, and as a consequence, the health outcome and associated levels of need and health support vary.

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